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To: bolla@physics.purdue.edu
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Subject: Parasitic power test results

Gino,

This is to summarize what we learned on Friday.

There are really no "parasitic diodes" which pull DVDD up from AVDD when the DVDD connection is lost. The "parasitic diodes" responsible are really input protection diodes on the control lines. If the DVDD connection is broken, then any control line which is at 5V (such as L1A) will forward bias one of its protection diodes which connects to DVDD. Now, there is a 250 ohm resistor is series with each control line on the chip, which connects the control pad to the protection diodes. So when DVDD breaks, DVDD gets pulled up through a resistor and diode to around 3.4V or so by any and all control lines which are at 5V. If the 250 ohm resistors were not present, then presumably DVDD would get pulled up to a diode drop below 5V, and the chip might actually operate.

We tried pulling the L1A control line to from 5V to 6.5V to observe the effect on DVDD, and unfortunately, DVDD only goes up by a couple tenths of a volt -- no surprise.

When the DVDD connection is broken and DVDD then goes to say 3.4V, the AVDD current is seen to increase significantly. It might seem as if AVDD is now supplying the current for DVDD, but this is not the case. This is just extra AVDD current being sunk directly to ground through the "QVDD" pads. The QVDD pads are tied to the analog supply and supply the power for digital drivers which drive the pipeline cap switches. But the inputs for these drivers come from the digital circuitry powered by DVDD. This means that the pipeline driver inputs which are supposed to be high are now at reduced voltage -- 2.4V instead of 5V. But the supply voltage for these drivers remains at 5V. Any driver with its input NOT at one of the rails just draws current from the supply and dissipates extra power. This is the reason for the AVDD current increasing.

It might be interesting to try again to pull DVDD up by raising the voltage on a control line. For example, lets take the CALSTR line which has no function during normal operation. If we pull it significantly higher than 6.5V, we might get DVDD high enough to actually get the chip to operate. There is only a 250 resistor attached to the pad, so we shouldn't really damage anything else by raising this voltage higher. However, we have to be careful. The DVDD current draw is about 10 mA or so, then jumps to 100mA when reading out, right? So if we make sure to read out with LOW duty cycle, then the average current draw should only be somewhat higher than 10mA, and hopefully the hybrid bypass caps can supply the charge needed for readout, and the DVDD voltage maybe won't change too much. (If we read out at a high duty cycle and get DVDD pulled up to around 5V, then stop reading out, the DVDD voltage might go quite a bit higher, which would be bad).

The trick here would be how to raise one control line only, after it functions normally in intialize mode. I can imagine a scheme where you might put a diode between the DDR and the SVX3 CALSTR line, and then hook a power supply through a diode to the CALSTR line which you could turn up when you want to (after the SVX initializes). I'm just thinking out loud here... does this make any sense and might it be worth more time?? If this kind of thing could succeed, I don't know if it would be very practical in the real system.

Tom